Initial Workshop of Gear Modification Options to
Reduce the Mortality of Bottlenose Dolphins in Fishing Gear

May 17, 2001
9:30am - 3:00pm
NMFS Beaufort Lab
Beaufort, NC

Final Meeting Summary

Participants:

Jim Bahen (NC Sea Grant); Paul Biermann (NC commercial fisherman); Diane Borggaard (NMFS); Barbie Byrd (NMFS); Megan Cope (NMFS); Michael Cowdrey (NC commercial fisherman); Tara Cox (Duke Marine Lab); Bill Foster (NMFS); Jeff Gearhart (NCDMF); Emily Hanson (NMFS); Dr. Aleta Hohn (NMFS); Nick Hopkins (NMFS); Don King (Atlantic Gillnet Supply Inc.); Parks Lewis (North Carolina Division of Marine Fisheries-NCDMF); Red Munden (NCDMF); Robert Munson (NJ commercial fisherman); Dr. Paul Nachtigall (Hawaii Institute of Marine Biology); Dr. Debi Palka (NMFS) Ann Pierce (NC Sea Grant); Carl Poppell (GA commercial fisherman); Glenn Salvador (NMFS); Dustin Schrimpsher (North Carolina Fisheries Association); Robert Southerland (NC commercial fisherman); Carolyn Steve (NMFS); Dave Swanner (NC commercial fisherman); Walt Walters (Fumunda Marine Products); Dr. Kathy Wang (NMFS); Danielle Waples (Duke Marine Lab)

Introduction:

Dr. Kathy Wang began the meeting with introductions, then proceeded to discuss the purpose and objectives of the meeting. The purpose of the meeting was to discuss fishing practices and both short- and long-term needs in gear development to reduce the potential for interaction with marine mammals in the mid-Atlantic and south Atlantic. In advance of the upcoming Bottlenose Dolphin Take Reduction Team meetings, the first gear workshop would focus discussion on the fisheries that interact with bottlenose dolphins and possible gear modifications to reduce the potential for interaction. The objectives of the workshop were to 1) provide a forum for fishermen to exchange ideas on possible modifications to gear or fishing practices that may reduce the potential for interaction with marine mammals; and 2) discuss these options in the context of what is known regarding how and why marine mammal/gear interactions occur. The various Atlantic marine mammal Take Reduction Teams will review this information in developing recommendations to NMFS. Dr. Wang indicated that serious injury and mortality of bottlenose dolphins are above sustainable levels and interactions need to be reduced from Long Island Sound to the Gulf of Mexico.

Hearing and Echolocation in Dolphins and Small Whales. Dr. Paul Nachtigall, from the Hawaii Institute of Marine Biology reviewed how dolphins hear and echolocate. Dolphins hear well at high frequencies up to 150 kHz. At these high frequencies the wavelengths are shorter and allow the dolphins to receive more information and energy from its target. For comparison, humans hear frequencies up to 18 kHz. When dolphins echolocate they emit short and loud pulses that are 50 milliseconds long and up to 225 decibels. Echos from these pulses return to the dolphins at

approximately 30 decibels and the dolphins take this sound and make sense of it. Bottlenose dolphin and harbor porpoise use such echolocation to catch fish. The echolocation sounds of bottlenose dolphin are directed and focused through the melon fat in the forehead. Echolocation pulses are broad band with frequencies ranging from 10 to 150 kHz across all energies. As an example, Dr. Nachtigall noted that Navy sonar machines use narrow band low frequencies that work at great distances, whereas dolphins use high frequencies that have a more limited range but have the ability to detect greater detail (e.g. dolphins can detect a water filled steel ball at 110 yards). Dr. Nachtigall said the question for the group was how can dolphins and porpoises use echolocation to detect and avoid nets. Some techniques that have been used to make nets more visible include reflective materials and attaching pingers that emit pulses. A question and answer period then followed:

- *Can dolphins detect nets in shallow water with currents?* Dr. Nachtigall's response was that nets, if anchored and not drifting, produce a low frequency (approximately 1000 Hz) strumming noise that dolphins are unable to detect. However, if the net was stiffer and anchored, the frequency of the strumming noise would increase and the dolphins may be better able to detect the presence of the net.

- *What about using plastic floats to increase the visibility of gillnets?* Dr. Nachtigall responded that floats are more visible to dolphins if they are located underwater rather than on the surface. The ability of the floats to be detected by dolphins is affected by the composition of the floats. Floats are more reflective if they are made of material with a density different from that of water, such as foam floats or floats filled with air.

- *How often do dolphins echolocate?* One participant mentioned a study which indicated that dolphins echolocate 20% of the time. Participants were interested in reading more about this study. Dr. Nachtigall confirmed that dolphins frequently engage in passive listening and do not always echolocate. He also noted that animals in groups tend to echolocate more often.

- *Do dolphins preferentially follow boats?* Gillnet and crab fishermen said that dolphins follow their boats and will eat bait in their pots, as well as any of their catch or bycatch. When fishermen in Georgia modified their traps so dolphins couldn't get at bait (i.e. they used an inverted bait well), the "stealing" behavior stopped. When a gillnet and crab fisherman stopped throwing discards overboard, they found that dolphins stopped

following them. Dr. Hohn mentioned that a recent analysis found no co-occurrence of dolphin and gillnet distribution indicating that generally dolphins are not seeking out gillnets to feed upon their contents. Dr. Hohn noted that dolphins may become entangled in the nets due to inexperience or accidental contact.

- *Are entangled animals younger?* Dr. Hohn mentioned that most entangled animals are sub-adults that wash up on the beach. This may result from the fact that more sub-adults get entangled, or some factor which may increase the likelihood that sub-adults will wash up on the beach. However, Dr. Hohn noted that the number of juvenile bottlenose dolphin with evidence of human interaction needs to be compared against mortality/survivorship curves to test this theory.

- *Are smaller meshes more detectable?* Dr. Nachtigall replied that perhaps smaller meshes are more detectable, but that gillnets in general are not very reflective. Dave Swanner indicated that instead of mesh size, it might be more important to focus on how many fish are in the net, as nets with a greater number of fish might act as more of a signal to dolphins. Paul Biermann supported this theory by noting that dolphins hang out by nets full of fish and move on when nets are empty. Dave suggested that perhaps the characteristics of the fish in the net might be a factor. He noted that when the water is clear dolphins tend to eat shinier fish such as Spanish mackerel, rather than darker fish such as bluefish.

Review of Gear Characteristics. The participating fishermen reviewed the gear characteristics of their fisheries.

- Dave Swanner, a Hatteras shrimp and gillnet fisherman, said that he doesn't anchor his nets except for night sets. He noted that he also anchors nets in the spring when fishing for sea mullet. Dave mentioned that the type of gillnet used varies with season; coarse mesh (0.66–0.70mm; 0.90-1.05mm for bluefish) nets are used in the winter and finer mesh (177-208 for Spanish mackerel) nets are used in the summer. In the winter the nets are deployed in deep water and in spring the nets are deployed in shallower water. Dave indicated that bottlenose dolphins start begging in the spring and they don't seem to beg when the water temperature is below 59°F. He noted that begging is particularly bad during the summer months. Dave said that dolphins tend not to exhibit begging behavior when the fishermen are engaged in shrimping activities.

- Paul, a Beaufort gillnet fisherman, reported that during the winter he deploys nets in shallow water for croaker, trout, and sea mullet, and during the spring he deploys 400 yards of net (100 meshes deep, 0.62mm twine, 3-3 3/4" mesh) at a depth of 21 feet for Spanish mackerel. Paul places a 5 oz. float every 6 feet at the surface of the net, and a 100-pound/600' lead line on the bottom. Paul noted that he sets the gear when slicks of feeding fish are visible. The nets are not anchored and he stays with his gear at all times, usually soaking the nets for a maximum of one hour.
- Bob Munson, a Delaware crab and gillnet fisherman, reported that he fishes inside the bay and targets menhaden with nets from April through September. He fishes in 4' to 6' deep water at low tide and the nets cover the water column from top to bottom. He deploys an anchored array of 4 nets (3 3/4 - 4" mesh; 0.52mm twine; hung on halves or thirds; 2 oz. weight/ft; 4 oz. positive floats; 50' between nets), or panels, with an 80-150-lb anchor at the end of each net due to the 4.5-5 knot currents. Bob noted that he leaves the net array out for 4-6 months and can replace panels with different mesh sizes if necessary. All individual nets are connected to a leader by snaps, and Bob stated that he can control his catch through the number of individual nets, or panels, he deploys at one time. He has to tend the nets 2-4 times each day to ensure the high quality of the fish; his only bycatch has been horseshoe crabs. Bob noted that some fishermen use sink nets or drift nets in the open ocean use, some with anchors attached. His crab pots are 2"x2" mesh, 20" high with 4 entry doors set at a 3:1 ratio of line to water depth and with 2 or 3 buoys on the same line.
- Mike Cowdrey, a Sneads Ferry shrimp, pot and trawl fisherman, reported that he uses sink nets (2 ½", 20-40 mesh deep, 208 twine nets) to catch whiting/sea mullet after a 24 hour soak time during the rising tide. Mike said that he uses a larger mesh to prevent finger mullet from being caught in his nets. He also fishes black sea bass pots (1 trap, 1 line) offshore and near the ledges in 120 feet depth. Mike reported that his black bass pots are 2' x 2' square with 1" square openings and he used 5/16" poly twine with double yellow floats. He stated that there is iron on the bottom of the pots and a tie line, but no bridle.
- Carl Poppell, a Georgia crab fisherman, reported trends opposite to those reported by Dave Swanner. Carl has observed that dolphins tend to leave the area in the spring to beg around the shrimp trawlers. He described his pots as 2' x 2' square with #10 sinking rope, 3/4" rebar, a 5x11 floating buoy, a mandatory ring, and an inverted bait well. Carl reported that he uses one 17-pound trap per line and that he sets the traps 25-75 yards apart at a depth of 2 to 25 feet. The inverted bait well makes it more difficult to fish (it adds 1-1.5 hours of work per day) but prevents the bottlenose dolphins from breaking the

traps and stealing the bait. However, Carl noted that the bottlenose dolphins still follow the crabbing boats. He stated that crabbers limit themselves to 200 pots even though the state allows 300. Georgia capped the fishery at 159 licenses so if a fisherman wants to enter the fishery he has to buy someone out or enter into the state lottery system. Carl also reported that a crab trap recycling program exists, but that it is voluntary and handled by the state.

- Robert Southerland, a Wilmington trawl fisherman, noted that Georgia has 32,000 to 36,000 crab pots while North Carolina has 1,200,000, and that a crap trap recycling program exists in North Carolina as well.

Recreational fisheries: Jim Bahen from NC Sea Grant brought up the issue of recreational fishing/marine mammal interactions. It was noted that recreational fishers can use limited amounts of commercial gear and that 6500 licenses currently exist although it is unknown how many licensed fishers use recreational gillnet. Dr. Wang reported that takes in recreational gear are illegal, but that the Marine Mammal Protection Act does not give NMFS authority over regulation of recreational fishermen, only commercial fishermen. However, she noted that Take Reduction Teams can make recommendations to states such as North Carolina to address such interactions. Red pointed out that the current North Carolina rules have attendance requirements for small mesh recreational gillnets (e.g. those used to catch spot), but not for large mesh recreational gillnets (e.g. those used to catch flounder). Bill Foster remarked that these requirements virtually eliminated recreational gillnets in Pamlico Sound near Hatteras. Red noted that the rules require recreational gillnets to have a pink buoy. He stated that, while in the past unlimited quantities of recreational gear were used, the rules currently allow only 5 pots, 25 feet of shrimp trawl and 100 yards of gillnet for the $35 license fee. The Fisheries Reform Act limited recreational use of commercial gear. Other fishermen noted that Virginia and Delaware allow recreational gillnets as well.

Reported Interactions: One fisherman recalled two interactions when in the beach/haul seine fishery: a humpback whale that was caught in the bridle and a bottlenose dolphin that was caught in the net - both were released alive. Another fisherman has had only one bottlenose dolphin interaction with a bottlenose dolphin when it became entangled in his Spanish mackerel gear: the dolphin was caught on the hook near that end of the beach-set net before any fish had been caught. The fisherman thought that perhaps the dolphin was trying to get around the net, but that its attempts to do so failed. Another fisherman reported that in 30 years of fishing he has never had an interaction with a bottlenose dolphin; he sees them in the middle of the bay but not along

the shore where his nets are deployed. This fisherman did mention that he has had interactions with sea turtles, but that they are usually released alive. Another fisherman mentioned that turtles eat his bait but most escape unharmed. Another fisherman noted that he never caught a dolphin in his net, but a dolphin did steal a fish while he was trolling. The dolphin broke the line and swam off with some of the line. This same fisherman reported that dolphins eat bycatch from shrimp boats but he has never caught a dolphin. Another fisherman reported that a dolphin did get caught on the lazy line of his shrimp trawl but he was able to release the animal alive. Another fisherman reported that in 29 years of fishing he has only had one interaction with a bottlenose dolphin: the dolphin's tail was tangled in the pot line and the dolphin was released alive.

Current Gear Modifications. Glenn Salvador, a Gear Specialist from the Northeast Region, presented information on current gear modifications being implemented or developed for existing take reduction plans (Note: see regulations for complete requirements).

- *Large Whale Take Reduction Plan*: Glenn reported that as part of the Large Whale Take Reduction Plan the state lobster fishery must have one of four requirements:
    1. Buoy lines of 7/16" diameter or less.
    2. A knotless weak link attached to the buoy line with 600-pound breaking strength.
    3. Buoy lines made only of sinking line.
    4. Ground lines made only of sinking line.

  Glenn stated that these modifications were determined by looking at past entanglements, talking with scientists about whale behavior, and looking at the strain on the gear (via load cells). He went on to report that the lobster fishery in federal waters must have all four of the following requirements:
    1. A knotless weak link attached to the buoy line with 600-pound breaking strength.
    2. Multiple trap trawls (i.e. to reduce the number of lines in the water; no single traps).
    3. One buoy line on all trawls, up to 5 traps.
    4. Gear marking on buoy lines.
- *Harbor Porpoise Take Reduction Plan*: Glenn reported that the Harbor Porpoise Take Reduction Plan uses two strategies to decrease harbor porpoise/fishery interactions: closed areas and gear modifications. He stated that most of the closed areas in the Northeast remain open to fishermen who use pingers (one at each bridle, one at each end) that emit a 10kHz pulse every 4 seconds and that cost $95 each. Glenn noted that according to

fishermen, shad, herring, and menhaden will avoid nets with pingers, and he suggested this is because these fish species may be able to detect the 10kHz frequency. He also reported that in the mid-Atlantic region, gear modifications such as heavier twine (0.81mm) are used in place of pingers as this was found to be successful in preventing harbor porpoise bycatch.

Gear Modifications and Fishery Interactions w/Small Cetaceans. Glenn Salvador facilitated discussions of possible gear modifications to reduce fishery interactions with small cetaceans, as well as plans to develop and test gear modifications.

- Tara Cox summarized preliminary results from a May 2001 study done off of Fort Macon, NC, that looked at how bottlenose dolphins respond to pingers. Dave Swanner set a net with a pinger off the beach, and Tara and other observers tracked the dolphins around the net with a theodolite. Tara and the other observers did not know whether the pinger was on or off until then end of the day. She reported that no official analysis has been performed yet, but bottlenose dolphins were observed in areas where the pingers were deployed. Additionally, dolphins appeared to be very net savvy; for example, one group of dolphins dove on the net for 10 minutes. Research seems to indicate that harbor porpoises may be displaced when pingers are turned on but preliminary results from this study indicate that bottlenose dolphins do not appear to be displaced and may be attracted to the pinger. Diane Borggaard noted that a Florida hook-and-line fishermen tried to use pingers to keep dolphins away from his bait, but reported the pingers did not work and may have even attracted dolphins.
- Don King from Atlantic Gillnet Supply Inc. presented information on acoustically reflective net. Nylon 6 has a density close to that of sea water but its density and reflectivity can be increased if it is metallicized (e.g. filling with barium sulfate). Don worked with researchers to test reflective nets in the Bay of Fundy. During this study, 12 harbor porpoise were caught in conventional nets and none were caught in the reflective nets. Don also was involved in a study in Denmark in which 5 harbor porpoises were caught in conventional nets and none were caught in the reflective nets. Don noted that there was some affect on the fishability on the nets in Denmark but there may have been other factors involved which affected this outcome. He pointed out that in the Bay of Fundy study there was little overall difference in fish catch; there were some nets which caught more cod and some that caught less, but the number of pollock remained the same with both net types. Don mentioned that conventional nets are transparent, whereas the reflective nets are not. However, they can be dyed any color. Don mentioned that he

hopes to get an experimental fishing permit to test whether reflective gillnets are successful at decreasing harbor porpoise bycatch in the Gulf of Maine pingered net only zones. Don also noted that pingers have a 68% compliance and a 30% failure rate. Presently there are boats in Gloucester using the reflective nets and they report that the nets are fishable. Don would also like to test reflective nets in the mid-Atlantic and has submitted a proposal to test the fishability of 20 different nets with 5 different mesh sizes. Don asked for feedback from mid-Atlantic fishermen on the type of nets that should be constructed. He also noted that he would like to test if the nets decrease turtle and bird bycatch. Don noted that the Bay of Fundy study suggested that bird bycatch was less in reflective nets compared to conventional nets. A question and answer period followed:

- *Won't it be expensive to replace the old gear with the newer reflective gear?* Don replied that perhaps the new nets could be grandfathered in as people replace their gear over the years. However, he did mention the necessity of decreasing takes to below PBR sooner than would be achieved in this time-frame. He also mentioned that the reflective nets may last longer than conventional nets.

- *Could there be a different pinger frequency that will work with bottlenose dolphins?* Don noted that the frequency of 30kHz may work, but noted that people cannot hear this frequency to know if the pinger is working. According to Don, studies found that harbor porpoises considered the actual noise aversive and were repelled by the pingers, not by the realization that a net was there or by the lack of fish caught in the particular net.

Pingers. Walt Walters, from Fumunda Marine Products, spoke about pingers and their use in the Pacific Offshore Take Reduction Plan. He stated that pingers were originally manufactured for the swordfish driftnet fishery for use with 6000-foot long nets at a depth of 200 feet. Walt noted that the pingers he manufactures are different from the Dukane pingers, although they have the same specifications – 10KHz pulse every 4 sec, 132 dB. He said that the Fumunda pingers work better in cold water because the lithium battery allows the voltage to remain constant over a longer period of time- approximately 11 months to 1 year- meaning that the output also remains constant. Walt noted that Fumunda pingers are also more fusiform; they can be permanently attached to the float and lead lines and wrapped around the net reel if necessary, and they run continuously with microprocessor control and no saltwater switches. Walt noted that Fumunda pingers do not float and that fishermen have requested buoyant pingers. He is currently testing pingers manufactured out of polypropylene on fishing boats in the Gulf of Maine but there are

currently no results available from this study. Walt stated that pingers have been found to be effective for both harbor porpoises and common dolphins, and that the pingers can be modified by altering the frequency of the pulse or by adding indicator lights to individual pingers. Walt noted that Fumunda pingers are $80 and Fumunda is testing a water detech circuit incorporated to eliminate operation when the unit is not deployed. Additionally, he mentioned that Fumunda pingers had a failure rate of approximately 1% in 2000, and the compliance rate should be much higher than the rate Don King noted for other pinger types due to the microprocessor based design and lithium battery power. Walt indicated that Airmar, another pinger manufacturer, is experimenting with 40-60 kHz pingers this upcoming fall. Walt noted that preliminary tests conducted at Hubbs-Sea World Research Institute in San Diego with bottlenose dolphins and pingers (in a pool), resulted in aggressive behavior towards the pingers by several of the animals, while others exhibited no concern. Walt noted that a study will take place to test the affect of a 500 Hz pinger on turtles.

Future Research. Bill Foster, NMFS Fisheries Outreach Coordinator, noted that NMFS is encouraging cooperative research efforts with fishermen and academia to test gear, as well as cooperative efforts to locate funding sources. He mentioned that he was hired to facilitate such efforts and develop new ideas to implement take reduction plans. Bill encouraged research in North Carolina and the more southern waters. Nick Hopkins from the NMFS Pascagoula Lab mentioned that his facility performs various gear research studies such as diving around shrimp trawls to investigate the functionality of TEDs and the behavior of turtles around them. Paul Nachtigall from the Hawaii Institute of Marine Biology mentioned that his facility has captive dolphins and suggested that reflective nets could be tested with captive dolphins to determine their threshold of detection. Don King from Atlantic Gillnet Supply, Inc. mentioned the possibility of manufacturing nets that are “hybrids” with strips of acoustically reflective material.

Handouts:

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NMFS. 1999. Summary of the final rule implementing the Atlantic Large Whale Take Reduction Plan. 15pp.

NMFS. 1998. Harbor Porpoise Take Reduction Plan Press Guide. 8 pp.